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EXAMINER	
CHEN, ERIC BRICE	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 06/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/766,776	DOAN, JONATHAN
	Examiner	Art Unit
	Eric B. Chen	1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 11 May 2006.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-50 and 52-118 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) 1-26, 46-50, and 52-88 is/are allowed.

6)☒ Claim(s) 27,29-31,33-40,42-45,89-99,101-112 and 114-118 is/are rejected.

7)☒ Claim(s) 28,32,41,52,93,100, and 113 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Previously Allowable Subject Matter

1. The indicated allowable subject matter of claim 22 is withdrawn in view of the references to True and Wolf. Although the indicated allowable subject matter of dependent claim 22 has been rendered moot in view of the allowance of independent base claim 1, independent claim 27 contains similar claim limitation as claim 22. Rejections based on the cited references follow.

Claim Objections

2. Claim 93 is objected to because of the following informalities: the status identifier for claim 93 should apparently be -- (original) -- instead of "(cancelled)." Appropriate correction is required.

3. Claims 52 and 93 are objected to because of the following informalities: the claims are apparently missing periods.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 27, 29-31, 33, 34, 36, 38, 39, 42, 43, 89-93, 95, 97, 98, 101-106, 108, 110, 111, and 114-117 are rejected under 35 U.S.C. 103(a) as being unpatentable over True et al. (U.S. Patent Appl. Pub. No. 2001/0040675), in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986).

6. As to claim 27, True discloses a method of processing a deflectable element of a microelectromechanical device (paragraph 0004).

7. True does not expressly disclose oxidizing an amount of a material of the deflectable element equivalent to at least 20 percent of the volume of the deflectable element by exposing the deflectable element in an oxygen-containing gas other than air. However, True discloses that the flexibility of the deflectable element or hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize an amount of a material of the deflectable element equivalent to at least 20 percent of the volume of the deflectable element by exposing the deflectable element in an oxygen-containing gas other than air. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

8. As to claim 29, Wolf discloses that silicon oxidizes in air at room temperature (page 200). Wolf also discloses that silicon oxidizes at 700 °C (page 201). Thus, silicon would be expected to oxidize at a temperature of from 300°C to 500°C.

9. As to claim 30, True does not expressly disclose oxidizing an amount of the material of the deformable element equivalent to at least 60 percent of the volume of the deformable element. However, True discloses that the flexibility of the deformable element or hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize an amount of the material of the deformable element equivalent to at least 60 percent of the volume of the deformable element. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

10. As to claim 31, True does not expressly disclose oxidizing the deformable element such that the plastic deformation of the deformable element is reduced by at least 20 percent after a time period of from 2 minutes to 10,000 hours. However, True discloses that the flexibility of the deflectable element or hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Wolf

teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize the deformable element such that the plastic deformation of the deformable element is reduced by at least 20 percent after a time period of from 2 minutes to 10,000 hours. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

11. As to claim 33, Wolf discloses that wafers are commonly oxidized by loading the wafers into a chamber and introducing an oxygen-containing gas into an oxidizing system (or chamber) (pages 230-232), which inherently has a first pressure. Wolf also teaches that higher gas pressures can increase the oxide growth rate (pages 216-217). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include: a) loading the assembly into a chamber; b) introducing a first component of the oxygen-containing gas with a first pressure into the chamber, because Wolf teaches that these step are commonly used for wafer oxidation. Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to introduce a second component of the oxygen-containing gas with a second pressure higher than the first pressure into the chamber. One who is skilled in the art would be motivated to increase the oxide growth rate by increasing pressure.

12. As to claim 34, Wolf does not expressly disclose pumping out the chamber such that the pressure inside the chamber is lower than the first pressure; and repeating the steps b) and c). True discloses that the flexibility of the deformable element or hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to pump out the chamber such that the pressure inside the chamber is lower than the first pressure; and repeating the steps b) and c). One who is skilled in the art would be motivated to repeat the oxidation process until the appropriate flexibility of the deformable element is achieved.

13. Moreover, case law has held that the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin,* 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). The steps of pumping out the chamber such that the pressure inside the chamber is lower than the first pressure; and repeating the steps b) and c) is the splitting of one step into two.

14. As to claim 36, Wolf discloses that the oxygen-containing gas comprises air mixed with H_2O (pages 200-201).

15. As to claim 38, Wolf discloses that the oxygen-containing gas comprises oxygen mixed with H_2O (page 201).

16. As to claim 39, Wolf discloses that oxygen-containing gas is oxygen plasma (pages 218-219).

17. As to claim 42, True discloses that the deformable element comprises a material that is an elemental metal, metalloid, ceramic or metallic compound (paragraphs 0020, 0022).

18. As to claim 43, True discloses that the deformable element comprises a material that is selected from a group comprising: polycrystalline (polysilicon) and amorphous (silicon oxide) (paragraph 0020).

19. As to claim 89, True discloses a method of making a micromirror device (paragraph 0004), comprising: providing a substrate (10) (paragraph 0017; Figure 1A); depositing a hinge layer (20) (paragraph 0020) and a mirror plate layer (22) (paragraph 0021) on a sacrificial material (14) (paragraph 0018) on the substrate (10) (paragraph 0010) (Figures 1A-1D); patterning the hinge layer (20) (paragraph 0023); and removing the sacrificial layer (14) (paragraph 0026).

20. True does not expressly disclose oxidizing the hinge layer to form an oxidized hinge. However, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize the hinge layer to form an oxidized hinge. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling

the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

21. True does not expressly disclose removing the sacrificial layer after the step of oxidizing. However, performing the steps of the modified teaches of True and Wolf, including forming an oxidized hinge, would naturally encompass removal of the sacrificial layer (14) after the step of oxidizing.

22. As to claim 90, True does not expressly disclose that the step of patterning is performed before oxidizing the hinge layer, as in the modified teachings. However, case law has held that the transposition of two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin,* 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to pattern before oxidizing the hinge layer, as in the modified teachings.

23. As to claim 91, True does not expressly disclose that the step of patterning is performed after oxidizing the hinge layer, as in the modified teachings. However, case law has held that the transposition of two steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. *Ex parte Rubin,* 128 USPQ 440 (Bd. App. 1959); MPEP § 2144.04 (IV)(C). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to pattern after oxidizing the hinge layer, as in the modified teachings.

24. As to claim 92, Wolf discloses oxidizing with an oxygen-containing gas (page 201).

25. As to claim 93, Wolf discloses that the gas comprises more oxygen than is generally presented in air (page 201).

26. As to claim 95, Wolf discloses that the oxygen-containing gas comprises air mixed with H_2O (pages 200-201).

27. As to claim 97, Wolf discloses that the oxygen-containing gas comprises oxygen mixed with H_2O (page 201).

28. As to claim 98, Wolf discloses that the oxygen-containing gas is an oxygen plasma (pages 218-219). Wolf further discloses that downstream configuration is advantageous because radiation damage is minimized (page 570).

29. As to claim 101, True discloses that the hinge comprises a material that is an elemental metal, metalloid or metallic compound (paragraph 0022).

30. As to claim 102, True discloses that the hinge comprises a material that is ceramic (silicon nitride, silicon oxide, silicon carbide) (paragraph 0020).

31. As to claim 103, True discloses that the hinge comprises a material that is polycrystalline (polysilicon) (paragraph 0020).

32. As to claim 104, True discloses that the hinge comprises a material that is amorphous (silicon oxide) (paragraph 0020).

33. As to claim 105, True does not expressly disclose oxidizing an amount of a material of the hinge equivalent to 20% or more in volume of the hinge. However, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a

specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). True further teaches that the thickness of the hinge (20) ranges from 20 Å to 2100 Å, which is over a forty-fold increase in thickness (paragraph 0020). Wolf also teaches that oxidation of silicon is a well understood process and the total thickness or volume of the oxide can be accurately predicted (page 209). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize an amount of a material of the hinge equivalent to 20% or more in volume of the hinge. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

34. As to claim 106, True discloses a method of making a micromirror device (paragraph 0004), comprising: providing a substrate (10) (paragraph 0017; Figure 1A); forming a mirror plate (22) and hinge (20) on a sacrificial layer (14) on the substrate such that the mirror plate (22) is attached to the substrate (10) via the hinge (20) (paragraph 0022); and removing the sacrificial layer (14) (paragraphs 0026, 0039).

35. True does not expressly disclose cleaning and oxidizing the micromirror device, further comprising: providing a gas that is an oxygen-containing gas other than air, the oxygen-containing gas cleaning the micromirror and oxidizing an amount of the material of the hinge equivalent to at least 25% in volume of the hinge. True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the

thickness of the hinge (paragraph 0020). Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize an amount of the material of the hinge equivalent to at least 25% in volume of the hinge. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process. Moreover, the exposure of the micromirror to an oxygen-containing gas other than air would inherently clean the micromirror. See Wolf, page 564.

36. As to claim 108, Wolf discloses that silicon oxidizes in air at room temperature (page 200). Wolf also discloses that silicon oxidizes in water vapor (page 201). Thus, silicon would be expected to oxidize in the oxygen-containing gas comprising air mixed with H_2O.

37. As to claim 110, Wolf discloses that the oxygen-containing gas comprises oxygen mixed with H_2O (page 201).

38. As to claim 111, Wolf discloses that oxygen-containing gas is oxygen plasma (pages 218-219).

39. As to claim 114, True discloses that the deformable element comprises a material that is an elemental metal, metalloid or metallic compound (paragraphs 0020, 0022).

40. As to claim 115, True discloses that the hinge comprises a material that comprises aluminum (paragraph 0021). True also teaches that material could be a transition metal alloy (paragraph 0022), but does not expressly disclose titanium. Wolf teaches that titanium-aluminum alloys are important and commonly used during silicon device fabrication (page 374). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention as made to use a material that comprises titanium and aluminum, because Wolf teaches that such alloys are important and commonly used during silicon device fabrication.

41. As to claim 116, True discloses that the hinge comprises a material that is polycrystalline (polysilicon) (paragraph 0020).

42. As to claim 117, True discloses a method of processing a deflectable element of a microelectromechanical device (paragraph 0004).

43. Although True does not expressly disclose deflecting the deformable element (20), this step is also inherently present. Deformable element (20/50) is connected to mirror (54) (paragraph 0025; Figure 5A), which is supported by the sacrificial layer. Thus, after the sacrificial layer (14) is removed by the dry plasma oxygen step (paragraph 0026), hinge (20/50) undergoes a slight degree of bending (or deflecting) due to the force of gravity from the weight of the released mirror (50).

44. True does not expressly disclose oxidizing an amount of a material of the deflectable element equivalent to at least 20 percent of the volume of the deflectable element by exposing the deflectable element in an oxygen-containing gas other than air. However, True discloses that the flexibility of the deflectable element or hinge (20) can

be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize an amount of a material of the deflectable element equivalent to at least 20 percent of the volume of the deflectable element by exposing the deflectable element in an oxygen-containing gas other than air. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

Claim Rejections - 35 USC § 103

45. Claims 35, 37, 40, 94, 96, 99, 107, 109, and 112 are rejected under 35 U.S.C. 103(a) as being unpatentable over True, in view of Wolf, in further view of Yu et al. (U.S. Patent No. 6,180,543).

46. As to claims 35, 94, and 107, Wolf does not expressly disclose that the oxygen-containing gas comprises ozone. However, Yu discloses that a common oxidizing atmosphere contains additional compounds including ozone or hydrogen peroxide (column 3, lines 41-49, lines 60-63). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an oxygen-containing

gas comprising ozone, as taught by Yu. One who is skilled in the art would be motivated to use a commonly used oxidizing atmosphere, known to oxidize silicon.

47. As to claims 37, 96, and 109, Wolf discloses that the oxygen containing gas comprises H_2O (page 201). Wolf does not expressly disclose that the oxygen-containing gas comprises ozone. However, Yu discloses that a common oxidizing atmosphere contains additional compounds including ozone or hydrogen peroxide (column 3, lines 41-49, lines 60-63). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an oxygen-containing gas comprising ozone mixed with H_2O. One who is skilled in the art would be motivated to use a commonly used oxidizing atmosphere, known to oxidize silicon.

48. As to claims 40, 99, and 112, Wolf does not expressly disclose that the oxygen-containing gas comprises hydrogen peroxide. However, Yu discloses that a common oxidizing atmosphere contains additional compounds including ozone or hydrogen peroxide (column 3, lines 41-49, lines 60-63). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an oxygen-containing gas comprising hydrogen peroxide, as taught by Yu. One who is skilled in the art would be motivated to use a commonly used oxidizing atmosphere, known to oxidize silicon.

Claim Rejections - 35 USC § 103

49. Claims 44, 45, and 118 are rejected under 35 U.S.C. 103(a) as being unpatentable over True, in view of Wolf, in further view of Callister, *Materials Science and Engineering*, 4th ed., John Wiley & Sons (1997).

50. As to claims 44, True does not expressly disclose oxidizing the element such that the electrical resistance of hinge after oxidization is two times or more of the electrical resistance before oxidization. However, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). True further teaches that the thickness of the hinge (20) ranges from 20 Å to 2100 Å, which is over a forty-fold increase in thickness (paragraph 0020). Wolf also teaches that oxidation of silicon is a well understood process and the total thickness or volume of the oxide can be accurately predicted (page 209). Moreover, Callister teaches that electrical resistivity is directly related to the dimensions of the geometry of the structure (page 592), including a structure containing two different materials (page 601). In other words, there is a suggestion that resistivity can be used to measure the oxide thickness. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize the element such that the electrical resistance of the hinge after oxidization is two times or more of the electrical resistance before oxidization. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

51. As to claims 45, True doe not expressly disclose oxidizing the element such that the electrical resistance of hinge after oxidization is four times or more of the electrical resistance before oxidization. However, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). True further teaches that the thickness of the hinge (20) ranges from 20 Å to 2100 Å, which is over a forty-fold increase in thickness (paragraph 0020). Wolf also teaches that oxidation of silicon is a well understood process and the total thickness or volume of the oxide can be accurately predicted (page 209). Moreover, Callister teaches that electrical resistivity is directly related to the dimensions of the geometry of the structure (page 592), including a structure containing two different materials (page 601). In other words, there is a suggestion that resistivity can be used to measure the oxide thickness. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize the element such that the electrical resistance of the hinge after oxidization is four times or more of the electrical resistance before oxidization. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

52. As to claim 118, True discloses a method of processing a deflectable element of a microelectromechanical device (paragraph 0004).

53. Although True does not expressly disclose deflecting the deformable element (20), this step is also inherently present. Deformable element (20/50) is connected to

mirror (54) (paragraph 0025; Figure 5A), which is supported by the sacrificial layer. Thus, after the sacrificial layer (14) is removed by the dry plasma oxygen step (paragraph 0026), hinge (20/50) undergoes a slight degree of bending (or deflecting) due to the force of gravity from the weight of the released mirror (50).

54. True does not expressly disclose oxidizing the element such that the electrical resistance of hinge after oxidization is two times or more of the electrical resistance before oxidization. However, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). True further teaches that the thickness of the hinge (20) ranges from 20 Å to 2100 Å, which is over a forty-fold increase in thickness (paragraph 0020). Wolf also teaches that oxidation of silicon is a well understood process and the total thickness or volume of the oxide can be accurately predicted (page 209). Moreover, Callister teaches that electrical resistivity is directly related to the dimensions of the geometry of the structure (page 592), including a structure containing two different materials (page 601). In other words, there is a suggestion that resistivity can be used to measure the oxide thickness. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to oxidize the element such that the electrical resistance of the hinge after oxidization is two times or more of the electrical resistance before oxidization. One who is skilled in the art would be motivated to control the flexibility of the hinge by controlling the thickness of the hinge and selecting an oxide material, which can be produced by a well understood process.

Allowable Subject Matter

55. Claims 1-26, 46-50, and 52-88 are allowed.

56. The following is an examiner's statement of reasons for allowance for claim 1: there is no motivation or suggestion of deflecting the deformable element *with an electrostatic field* (emphasis added). The closest prior art, True, discloses that deformable element (20/50) is connected to mirror (54) (paragraph 0025; Figure 5A), which is supported by the sacrificial layer. Thus, after the sacrificial layer (14) is removed by the dry plasma oxygen step (paragraph 0026), hinge (20/50) undergoes a slight degree of bending (or deflecting) due to the force of gravity from the weight of the released mirror (50). However, there is no suggestion or motivation of deflecting the deformable element with an electrostatic field, as in the context of claim 1.

57. The following is an examiner's statement of reasons for allowance for claim 46: there is no motivation or suggestion of forming a *hinge* on the *first sacrificial layer*; and forming a mirror plate on the *second sacrificial layer* (emphasis added). The closest prior art, Doan, discloses forming a *mirror plate* (110) on the *first sacrificial layer* (100) (column 9, lines 7-9); and forming a *hinge* on (350/37) the *second sacrificial layer* (330) (column 10, lines 16-18) (emphasis added). However, there is no motivation or suggestion of forming a hinge of the first sacrificial layer; and forming a mirror plate on the second sacrificial layer, as in the context of claims 46.

58. The following is an examiner's statement of reasons for allowance for claim 69: there is no motivation or suggestion of deflecting the hinge to a deflected state *with an electrostatic field* (emphasis added), similar to the reasons discussed above.

59. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

60. Claims 28, 32, 41, 100, and 113 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

61. The following is a statement of reasons for the indication of allowable subject matter for claim 28: the prior art fails to teach or suggest that the oxidizing of the hinge reduces changes in a rest state of the mirror plate over time. The closest prior art, True, suggests that the flexibility of the deflectable element or hinge (20) can be adjusted by either selecting a specific hinge material or controlling the thickness of the hinge (paragraph 0020).

62. The following is a statement of reasons for the indication of allowable subject matter for claim 32: the prior art fails to teach or suggest introducing the oxygen-containing gas to the deformable element through a micro-opening of an assembly in which the deformable element is encapsulated, wherein the micro-opening has a dimension around 10 micrometers or less. Wolf teaches that silicon oxidation is commonly performed by placing wafers in an oxidation system (pages 230-232).

63. The following is a statement of reasons for the indication of allowable subject matter for claims 41, 100, and 113: the prior art fails to teach or suggest that the oxygen containing gas contains acetic acid. Wolf teaches that for the grown of uniform

oxides, additives include halogen based impurities (page 211). However, there is no motivation or suggestion of the oxygen containing gas containing acetic acid.

Response to Arguments

64. Applicant's arguments, (Applicants' Remarks, page 17, "Rejection of claim 1"), filed May 11, 2006, with respect to the rejection of claim 1 under 35 U.S.C. 102(b) as being anticipated by True, as evidenced by Wolf, have been fully considered and are persuasive. Neither True nor Wolf teach or suggest the claim limitation of "deflecting the deformable element with an electrostatic field." The rejection of claims 1-26 has been withdrawn.

65. Applicants' arguments (Applicants' Remarks, page 17, "Rejection of claim 27"), filed May 11, 2006, have been fully considered but they are not persuasive. As discussed above in the rejection of claim 27, the True and Wolf references suggest the claim elements of claim 27.

66. Applicants' arguments (Applicants' Remarks, pages 17-18, "Rejection of claim 46"), filed May 11, 2006, with respect to the rejection of claim 46 have been fully considered and are persuasive. The Doan reference does not teach or suggest "forming a hinge on the first sacrificial layer; and forming a mirror plate on the second sacrificial layer." The rejection of claims 46-50 and 52-68 has been withdrawn.

67. Applicants' arguments (Applicants' Remarks, page 18, "Rejection of claim 89"), filed May 11, 2006, have been fully considered but they are not persuasive. First, True discloses that the flexibility of the hinge (20) can be adjusted by either selecting a

specific hinge material (such as silicon nitride, silicon oxide, silicon carbide, polysilicon) or controlling the thickness of the hinge (paragraph 0020). Moreover, Wolf teaches that the oxidation of silicon is a well understood process with oxygen gas (pages 200-201) and that thin oxides can be grown in a controlled manner (pages 209-210). Thus, the modified teaching suggest that the hinge material can be formed by oxidizing the silicon hinge. It should be noted that this oxidizing step is separate from True's step of removing the sacrificial layer (14) (paragraph 0026). Moreover, performing the steps of the modified teaches of True and Wolf, including forming an oxidized hinge, would naturally encompass removal of the sacrificial layer (14) after the step of oxidizing.

68. Applicants' arguments (Applicants' Remarks, page 19, "Rejection of claim 106," second full paragraph), filed May 11, 2006, have been fully considered but they are not persuasive. Applicants argue that True and Wolf do not suggest a step of cleaning and oxidizing the micromirror device (page 19, second full paragraph). However, as cited in the Office action mailed Dec. 12, 2005 (page 19, paragraph 81), Wolf teaches that "O_2 plasmas provide a highly selective method for removing organic material, since O_2 plasmas do not etch Si, SiO_2, or Al" (page 564). In other words, the oxygen plasma cleans Si, SiO_2 or Al surfaces. Thus, the exposure of micromirror device to an oxygen plasma would inherently clean the device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-

2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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June 20, 2006

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